

NOTES ON THE
REGULATIONS GOVERNING THE
AIRWORTHINESS OF CIVIL AIRCRAFT
REGISTERED IN GREAT BRITAIN
AND NORTHERN IRELAND



Published by the Air Registration Board
Brettenham House, Lancaster Place, Strand, London, W.C.2

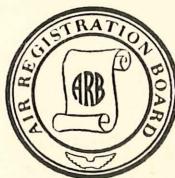
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AIR REGISTRATION BOARD

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A.R.B. HANDBOOK No. 1

Published by the Air Registration Board
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I

GENERAL

IN October 1919, an International Convention for the regulation of air navigation was signed in Paris.

The purpose of the Convention was to provide a minimum standard of safety which would be acceptable to the various countries that ratified it, but the details of how the standard should be achieved were left to the individual Governments.

The Convention was ratified by the British Government by the Air Navigation Act of 1920, and it is this Act which provides *inter alia* for regulations which in general terms control the airworthiness of British aircraft.

The Air Navigation Act of 1920 provides that, by an Order in Council, the British Government may make provision as to the manner and conditions of the issue and renewal of any certificate required by the Act. The Act itself does not attempt to detail any of the requirements, and the first step towards this was taken in the Statutory Rules and Orders which were made under this Act. Subsequently, similar action was taken under the Air Navigation Act of 1936. The current Statutory Rules and Orders are "The Air Navigation (Consolidation) Order 1923."

These Orders more fully describe airworthiness requirements, licensing of personnel and the regulations governing the operation of aircraft. The Orders are further explained by Air Navigation Directions 1936 (A.N.D. 13) and the Amendments to A.N.D. 13 which are termed "Regulations." These are issued from time to time on the authority of the Secretary of State for Air.

Where necessary, further explanations and points of detail affecting airworthiness are given in Notices to Aircraft Owners and Ground Engineers which are published periodically. (Detailed regulations governing the design and construction of

Convention relating to the Regulation of Aerial Navigation dated 13th Oct. 1919

Air Navigation Act 1920
10 & 11 Geo. 5

*The Air Navigation (Consolidation) Order 1923, dated 19th Dec. 1923 as amended by subsequent Orders

*This consolidated order is hereafter referred to as S.R. & O.

aircraft have been published by the Air Ministry in documents known as A.P. 1208, Vol. I and II). In summary form:—

1. International Convention 1919.
2. Air Navigation Act 1920 which ratified this Convention.
3. Statutory Rules and Orders made by the Secretary of State for Air under the Act at various times, the current Statutory Rules and Orders being known as The Air Navigation (Consolidation) Order 1923 amended by subsequent Orders.
4. *Air Navigation Directions 1936 (A.N.D. 13) and subsequent amendments which are directions made by the Secretary of State elaborating the Orders.
5. Notices to Aircraft Owners and Ground Engineers which are in the nature of explanation and advice as to details not dealt with in the Directions.
6. **A.P. 1208 Vol. I which lays down the design requirements that must be met to satisfy the general conditions of the Orders, Directions and Regulations.
7. **A.P. 1208 Vol. II which serves the same purpose in regard to inspection, construction and testing of materials.

The Air Navigation Act of 1936 gave powers to the Secretary of State for Air to delegate certain of his functions, and by Order he has delegated to the Air Registration Board *inter alia* the responsibility of making recommendations to him regarding the issue and renewal of Certificates of Airworthiness and the issue and renewal of licences to certain persons employed on aircraft construction and maintenance.

In the following pages the requirements of the Air Registration Board may by reason of this delegation be regarded as the requirements of the Secretary of State.

*Recently, amendments to the "Directions" have been called "Regulations" and in due course all the "Directions" will be known as "Regulations."

**The requirements of A.P. 1208 are acceptable to the Board pending the publication of its own requirements which are in preparation.

III

THE IDENTIFICATION AND MARKINGS APPLICABLE TO BRITISH REGISTERED AIRCRAFT

S.R. & O.
Article 3

S.R. & O.
Schedule I
Section B

REGISTERED MARKINGS.

THE national mark of British registered aircraft is the letter "G" in Roman character, and the registration mark is a group of four letters also in Roman characters. The letters must be displayed to the best possible advantage, taking into consideration the constructional features of the aircraft. The marks must always be kept clean and visible.

The letter "G" and the group of registration letters (without ornamentation) must be separated by a hyphen and must be painted once only across the upper and lower surfaces of the mainplane structure, with the top of the letters towards the leading edges of the mainplanes. The letters must also be painted on each side of the fuselage or hull between the mainplanes and tailplane.

The letters must be solid and of uniform colour contrasting clearly with the background on which they are placed. They need not exceed eight feet in height on large aircraft.

The width of each letter and the length of the hyphen must be two-thirds of the height of the letters and the thickness of the lines forming the letters and hyphen must be one-sixth of the height of the letters.

The letters constituting each group of markings on the mainplanes and on the fuselage or body must be of equal height and as large as it is possible to make them without their touching the visible outline of the surface on which the markings are placed.

OWNER'S NAMEPLATE.

All registered aircraft must have a metal nameplate fixed in a prominent position, upon which is stamped or engraved the registration marks and the registered owner's name and address. Any type of metal plate meets the official requirements, but a steel plate is recommended in case the aircraft is destroyed by fire and the plate is the only means of identification.

S.R. & O.
Schedule I
Para. 13

II

REGISTRATION

BEFORE application is made for the issue of a Certificate of Airworthiness, the aircraft should be registered and the following is a brief explanation of registration procedure.

S.R. & O.

Article 3

Para. (I) (i)

A.N.D. Section I

Application for registration of an aircraft is only accepted by the Air Ministry if the owner is a British subject or a British protected person. If the application is made by a company, then the Chairman and at least two-thirds of the Directors must be British subjects or British protected persons.

S.R. & O.

Schedule I

An aircraft may only be registered in one country at one time. A fee of one guinea must accompany the application form and, if the application is accepted, the Air Ministry will issue a Certificate of Registration. The certificate is not subject to renewal and is valid until change of ownership or until the aircraft is destroyed. In either of these events the owner should complete the appropriate section on page 3 of the certificate and forward it to the Air Ministry.

S.R. & O.

Schedule VI

Application for registration of an aircraft must be made to the Under-Secretary of State for Air, on a form which is supplied for the purpose (C.A. Form I).

S.R. & O.

Schedule I

Paras. (3) & (4)

Unregistered civil aircraft may only be flown with the written permission of the Secretary of State. This may be given for experimental and test purposes and in such cases special markings are issued by the Air Ministry.

A.N.D.

Section VI

Para. 61

An official list of aircraft registered in Great Britain and Northern Ireland is kept by the Air Ministry and may be consulted at any time on request.

A register of aircraft which is kept up to date by the issue of fortnightly supplements is published by the Board. Information as to the subscription and conditions of publication can be obtained on application to the Secretary.

IV

CLASSIFICATION

A BRITISH Certificate of Airworthiness may be issued to any aircraft registered in Great Britain and Northern Ireland provided that its design, construction and equipment meet the conditions laid down by the Secretary of State.

Every aircraft for which a Certificate of Airworthiness is granted will be classified as belonging to one or more of the following categories and subdivisions:—

1. *“Normal” Category.*

Subdivision (a) Public Transport for passengers.
„ (b) Public Transport for mails.
„ (c) Public Transport for goods.
„ (d) Private.
„ (e) Aerial work.

2. *“Special” Category.*

Subdivision (f) Racing or record.
„ (g) Research or experimental.

3. *“Acrobatic” Category.*

May include subdivisions (a) to (g).

The category in which an aircraft will be granted a Certificate of Airworthiness is mainly dependent on its design and construction. Aircraft in the “Normal” category are restricted to certain maximum air speeds and the engine or engines are not permitted to exceed a stated number of revolutions per minute. These maximum figures are indicated in the Certificate of Airworthiness. Aircraft in this category are precluded from acrobatic flying and from any evolution which might lead to abrupt variations in altitude.

The “Special” category is self-explanatory and Certificates of Airworthiness are usually issued to aircraft in this category for a particular flight and normally for very short periods.

Aircraft in the “Acrobatic” category are not restricted to a maximum air speed, and acrobatic manoeuvres may be performed.

S.R. & O.
Schedule II

A.N.D.
Section II
Para. 37

A.N.D.
Section II
Para. 38

DEFINITIONS OF SUBDIVISIONS.^[1]

(a) (b) (c) The words "Public Transport" mean in this connection that the aircraft may be used for carrying passengers, mails or goods for hire or reward. The restrictions of this subdivision are applicable where the carriage is effected by an air transport undertaking whether for hire or reward or not.

Thus if an aircraft owned by an operating company which normally engages in transporting for hire or reward, carries passengers, mails or goods free of charge, it must still comply with the regulations; non-payment for the carriage does not absolve the owners from compliance with the regulations.

(d) "Private Aircraft" are those used for purposes other than those specified above, and this category usually covers an aircraft operated by the private owner who may carry passengers but does not accept payment.

(e) "Aerial Work" aircraft are those used for any commercial or industrial purpose or for hire or reward purposes other than the carriage of passengers, mails or goods, as specified above. Examples are aircraft used for aerial photography, aerial survey work or crop spraying. These aircraft will probably incorporate special structural features or equipment.

(f) "Racing or Record" aircraft are those which are used exclusively for sporting or technical purposes.

(g) "Research or Experimental" aircraft are used exclusively for experimental flight. In practice they operate under a special form of permit issued by the Secretary of State, which is described in detail later.

Note : Aircraft used for flying instruction for which payment is made must hold a Certificate of Airworthiness in subdivision (a).

V

THE CERTIFICATE OF AIRWORTHINESS

THE British Certificate of Airworthiness is a four-page document internationally agreed and numbered "C.A. Form 59." It must be carried by *all* aircraft engaged on international navigation, and all public transport or aerial work aircraft whether engaged on international navigation or not. A specimen copy of C.A. Form 59 is given herewith.



**GREAT BRITAIN
AND NORTHERN IRELAND.**

Photograph of Aircraft
(in profile).

AIR MINISTRY.

CERTIFICATE OF AIRWORTHINESS No. 6841.....
(Heavier than air.)

FIRST PART.

FULL NAME, ADDRESS AND NATIONALITY OF OWNER OR OF OWNING COMPANY.

1. Surname of owner (or name of Company): **British Overseas Airways Corporation**
2. Christian name :
3. Address :
4. Nationality : **NAME OF CONSTRUCTOR.**
5. **De Havilland Aircraft Co.Ltd.** **NATIONALITY AND REGISTRATION MARKS.**
6. **British** **G-AFYE**

DESCRIPTION OF AIRCRAFT.

7. Type... **D.H. Flamingo** Series..... 95 Constructor's No. 95007.....
8. Place and year of construction of aircraft : **Hatfield, 1940**

Class of Aircraft.

9. Land and/or marine : **Landplane**
10. Number of planes : **One**
11. Number of engines : **Two**
12. Maximum number of persons to be carried (including crew) : **Thirteen**

Classification of Aircraft.

13. Category : **Normal**
14. Subdivision :

(a)	Public transport for passengers
(b)	Public transport for mails
(c)	Public transport for goods
(d)	Private (e) Aerial work

15. Maximum span (in flying position) : **70'**
16. Maximum length (in flying position) : **51.2'**
17. Total height (with and without trolley in case of seaplanes) : **15' 10"**

Engines.

18. Number installed : **Two**
19. Makes : **Bristol**
20. Types : **Perseus XVI**
21. International power of the engine or engines at mean sea level :

(a)	715/745 H.P. at 2,400	revolutions per minute. (International number of revolutions.)
(b)	- H.P. at -	revolutions per minute. (International number of revolutions.)

Hourly consumption at mean sea level at above-mentioned power per engine.....

22. Fuel : (a).....	60 $\frac{1}{2}$ gals.....	(b).....
23. Oil : (a).....	8/14 pints.....	(b).....

24. Airscrews.

Number fitted : Two

Types : (a) D.H. Hydromatic..... Design No. Hub P.X.502..... Pitch 150 - .830. Diameter 12.75'.....
 (b) 3-bladed metal Blade P.455253A

(c)

or any of the alternative airscrews approved in the current Notice to Aircraft Owners and Ground Engineers.

25. Weight of aircraft empty, including the water in the radiators :	11,528 lb.
Weight of fuel and oil (tanks full).	26. Fuel 5 (Calculated on a basis of 7.7 lb. per gallon.)
	27. Oil 225 (Calculated on a basis of 9.0 lb. per gallon.)
28. Weight allowed for crew	170 lb.
29. Weight allowed for equipment, excluding wireless apparatus :	352 lb.
30. Weight of wireless apparatus :	Nil lb.
31. Maximum commercial load (passengers-goods) authorised when the fuel and oil tanks are full, calculated on the weights specified in Items 25-30 :	2,310 lb.
32. Maximum total weight authorised :	17,600 lb.

COMPULSORY CONDITIONS.

33. Maximum total weight authorised (write in full). The total weight of the aircraft, including all items of load, is not to exceed seventeen thousand six hundred lb. in the normal category or one lb. in the category.

34. Minimum crew necessary : One

35. Inspections and overhauls :

- (a) The aircraft must be examined before flight in accordance with the Orders in Council for the time being in force under the Air Navigation Acts, 1920 and 1936.
- (b) The aircraft, each engine and its reduction gear, if any, must undergo overhauls of such nature and at such times as may be directed by the authorised ground engineers.

36. Stowage : The load must be safely distributed and suitably secured.

37. Distribution of the load : The aircraft must always be so loaded that the projection of the centre of gravity position on to the chord line of the (4xmes) main plane which lies in a section distant 60 inches from the plane of symmetry must fall within the limits of 33 inches and 46.5 inches behind the leading edge of the aforesaid chord line.

38. The number of passengers carried must not, in any circumstances, exceed the number for which seating accommodation is provided, except, however, that infants under the age of three years carried in the arms of passengers may be left out of account for this purpose.

39. Except in emergency the speed of the engine must not exceed 2,400 revolutions per minute for a total of more than five minutes in each flight or, if the flight exceeds one hour, in each hour of flight ; it must never exceed 3,750 revolutions per minute.

40. The aircraft shall only be flown in accordance with the conditions for flying machines of the normal category laid down in the Air Navigation Directions or Regulations for the time being in force whenever the total weight of the aircraft, including all items of load, exceeds 309 lb., and the aircraft must not then be flown at speeds in excess of 309 miles per hour indicated air speed. A notice to this effect must be displayed in the pilot's cockpit.

41. The boost pressure in the induction system must not exceed the rated boost pressure of $+ 1\frac{1}{4}$ lb./sq.in. except during take-off when the boost pressure must not exceed $+ 3\frac{1}{2}$ lb./sq.in. In the event of failure of one engine however, the other engine may be run at a boost of $+ 3$ lb./sq.in. for a total of not more than 30 minutes in any one flight.

42. The flaps are not to be lowered when the aircraft is flying at speeds in excess of 120 m.p.h. indicated air speed and when the flaps are down, this speed of 120 m.p.h. is not to be exceeded. A notice to this effect must be displayed in the pilot's cockpit.

43. (a) When the automatic pilot is in operation the speed of the aircraft is not to exceed 185 m.p.h. indicated air speed and a notice to this effect must be displayed in the pilot's cockpit.
 (b) The automatic pilot is not to be left unattended for longer than the minimum period necessary for the changing of the pilots.

44. The weight placed in the :-

- (a) front mail
- (b) front luggage compartments is not to exceed (a) 300 lbs
- (c) rear luggage (b) 600 lbs
- (c) 1100 lbs

and a notice to this effect must be displayed in each compartment.

45. Smoking in the aircraft is permitted in the passengers' cabin only.

COMPULSORY CONDITIONS—(continued).

46. The undercarriage must not be raised or lowered when the aircraft is flying at speeds in excess of 120 m.p.h. indicated air speed and when the undercarriage is down, a speed of 150 m.p.h. indicated air speed must not be exceeded. A notice to this effect must be displayed in the pilot's cockpit.

47. The octane value of the fuel used must not be lower than that of Specification D.T.D.230, (87 octane).

Note:

- If more than 378 gallons of fuel are put into the fuel tanks, the duration of any one flight must not exceed 6 hours, in order to avoid depleting the oil supply beyond safe limits.

Important Notice.—The maximum total weight authorised corresponds to the case of the aircraft flying in dry air, at an atmospheric pressure of 760 mm. mercury, and at a temperature of 15° Centigrade. This weight must not in any circumstances be exceeded.

The Secretary of State for Air, having regard to the Reports furnished to him, issues the present Certificate of Airworthiness dated.....in respect of the above-mentioned aircraft in accordance with the Convention for the Regulation of Aerial Navigation, dated 13th October, 1919, Annex B, and with the Air Navigation Acts, 1920 and 1936, and the Orders in Council in force thereunder.

This Certificate is only valid subject to the above compulsory conditions being fulfilled and until the date shown on page 4 hereon.

Signature..... *Date*.....
Director of Home Civil Aviation.

SECOND PART.

PRECAUTIONS TO BE TAKEN FOR SAFETY IN NAVIGATION.

A.—Description and position of instruments and material with which the aircraft must be equipped for navigation and which must be in perfect working order :

Instruments to be in accordance with the Air Navigation Directions or Regulations for the time being in force.

B.—Equipment essential for preventing or dealing with fire whilst in flight :

Hand fire extinguisher(s) in accordance with the Air Navigation Directions or Regulations for the time being in force.

C.—Equipment essential for rendering first aid in case of accident :

Attention is drawn to Article 9 of the Air Navigation (Consolidation) Order, 1923, which requires certain notices relating to smoking to be exhibited in aircraft carrying passengers for hire or reward.

Attention is drawn to the requirement of the Air Navigation Directions and Regulations that the owner of an aircraft, in respect of which a certificate of airworthiness is in force, shall not carry out any modifications which affect the safety of the aircraft without first obtaining the approval of the Secretary of State.

PERIODICAL OVERHAULS.

Date and Place of Overhaul.	Result of Overhaul (1).	Certificate Valid until	Signature of Experts.

(1) The periods of and reasons for suspensions and withdrawals of certificates of airworthiness will in particular be indicated in this column.

NOTES.

No entries or endorsements may be made on this Certificate except in the manner and by the persons authorised for that purpose by the Secretary of State.

If this Certificate is lost the Under-Secretary of State, Air Ministry, should be informed at once, the Certificate No. being quoted.

Any person finding this Certificate should forward it immediately to the Under-Secretary of State, Air Ministry.

Page 1 of the certificate carries a profile photograph of the aircraft, "quarter plate" $4\frac{1}{4}$ in. x $3\frac{1}{4}$ in. in size. The photograph may be of the actual aircraft concerned or one of a similar type. The certificate has a serial number and each clause or item is numbered. Page 1 headed "First Part," contains items 1 to 23 which detail the owner, constructor, type, classification, the maximum number of persons to be carried, certain over-all dimensions of the aircraft, the international power and revolutions of the engine or engines, and the fuel and oil consumptions.

On page 2, item 24 details particulars of the approved airscrews, and in some cases, the alternative types of airscrews which may be fitted. Items 25 to 32 state the empty weight of the aircraft, the weights of fuel and oil carried, weight of crew, weight of equipment and wireless apparatus, the maximum commercial load and the maximum total weight authorized.

The remainder of page 2 and occasionally part of page 3 contain the Compulsory Conditions and Warning Notes commencing at item 33. The Compulsory Conditions define the loading of the aircraft particularly in respect of the position of the centre of gravity and the speed limitations of the aircraft and engines when in flight.

The Warning Notes may draw attention to the fact that, when the petrol and oil tanks are full, the full complement of passengers may not be carried, or may refer to the necessity of using suitable aerodromes for take-off and landing and the desirability of avoiding flying in gusty weather when fully laden.

Page 3 also gives certain extracts from the regulations and indicates the date of issue of the certificate.

Page 4 is reserved for details of overhauls for renewal and extension of the certificate, and on this page is entered the date of expiry of its validity and any periods of suspension.

VI

APPLICATION FOR A CERTIFICATE OF AIRWORTHINESS

FORMAL application for the issue of a Certificate of Airworthiness is first made on a form (C.A. Form 3) obtainable from the Air Ministry. The form provides for the name, address and

A.N.D.
Section II

nationality of the owner, the name of the constructor, the registration marks, a brief description of the aircraft and the approximate empty weight and classification (see page 7).

The applicant is requested to state whether the aircraft is of new design, or if it conforms in all respects to one for which a Certificate of Airworthiness has already been issued. From the answer to this question it is possible to judge whether the aircraft is a "Type" aircraft or a "Subsequent" aircraft.

A "Type" aircraft is the first aircraft of its kind which differs substantially in design and construction from any aircraft previously granted a Certificate of Airworthiness.

A "Subsequent" aircraft is one which conforms in all essential respects affecting the safety of the aircraft to a "Type" aircraft for which a Certificate of Airworthiness has already been granted.

An aircraft may also be defined as "Type (Reduced Fee)."

A "Type (Reduced Fee)" aircraft is one which, although substantially similar to the "Type" aircraft, embodies modifications hitherto unapproved which affect the safety of the aircraft.

The application form (C.A. Form 3) should, when complete, be forwarded to the Board with the appropriate fee for the issue of a Certificate of Airworthiness. A list of fees is given at the end of this handbook on page 43.

VII

THE ISSUE OF A CERTIFICATE OF AIRWORTHINESS FOR A "TYPE" AIRCRAFT

S.R. & O.
Schedule II
Para. 5

A.N.D.
Section II

THE terms of Schedule II of the Statutory Order require that the Secretary of State should be satisfied on various points, namely that :—

- (a) the design has been approved by the Board in regard to safety ;
- (b) the construction has been approved by the Board in regard to workmanship and material used ;
- (c) the aircraft is fitted with the prescribed instruments and equipment, and

(d) a satisfactory demonstration in accordance with the requirements of the Board has been made in flying trials that the aircraft is safe for the purpose for which it is intended.

DESIGN.

The methods of obtaining approval of design are set out in the Air Navigation Directions as amended by the Air Navigation Regulations. Method (I) is applicable to aircraft designed by persons or firms recognized by the Board as persons or firms "approved" for this purpose (see A.R.B. Handbook No. 3). In this method, a measure of approval of design, checking of strength calculations, and testing of components, are delegated to the approved firm but the Board requires that all design data shall be at its disposal.

A.N.D.
Section II
Paras. 7-18

Method (II) applies to aircraft designed by firms or individuals not so approved.

If an individual or a small firm designs and constructs an aircraft and desires that the aircraft should hold a Certificate of Airworthiness, the first step would be the submission of a formal application for the issue of a Certificate of Airworthiness as detailed in Section VI of this handbook (page 13).*

The applicant would then be required to submit to the Air Registration Board such particulars as are necessary for the Board to form an opinion as to the safety of the aircraft from the point of view of design.

If the design incorporates unusual features then the Board may require further evidence to show that the aircraft complies with required standards.

A.N.D.
Section II
Para. 10

The particulars submitted must include general arrangement drawings of the proposed aircraft and, in the case of an individual or firm designing an aircraft for the first time, the Board will require that the drawings and strength calculations shall be submitted through a recognized channel such as an approved firm or a consultant who is already acquainted with the requirements and the standard methods of calculations employed. In

A.N.D.
Section II
Paras. 7-18

*It should be pointed out here that it may not be absolutely essential that an aircraft which is to be used for purely private purposes should have a Certificate of Airworthiness, but it is assumed in these notes that the designer will not want to limit the use of his aircraft in this way and that he will desire that the aircraft may be used for hire or reward, that is, for the carriage of passengers, mails or freight, for aerial work or by a club or school for flying instructional purposes or for private flying internationally.

any case, the Board would require the applicant to produce evidence that all calculations had been checked for arithmetical accuracy.

The more desirable procedure would be that an "Unapproved" designer should employ persons who, by their training and experience, are qualified to give an undertaking that the design conforms to the requirements and, in such case, the applicant would probably approach the Board to ascertain whether in fact his organization could be considered as approved.

In the case of both the approved and unapproved designers, the Board requires that the complete design and strength calculations, together with any necessary tests, shall have been made before the construction of the aircraft is very far advanced.

The procedure is that all design data, calculations, reports on tests and drawings of the "Type" aircraft

- (a) shall be in accordance with civil design requirements, and
- (b) shall be held at the disposal of the Board.

In every case the designer will be required to produce a Type Record. This Type Record is a summary of the Type design to the date when the aircraft is ready for its flight trials. Any modifications made to the design at a later stage must be covered by an addendum to the Type Record and the modifications must be approved by the Board.

This record includes the following information :—

- (1) a summary of the performance and strength calculations ;
- (2) copies of the more important strength tests reports ;
- (3) copies of wind tunnel and other test reports ;
- (4) diagrams of the fuel, oil, cooling, electrical, wireless and instrument installations ;
- (5) a report of the flight trials ;
- (6) a note of any design peculiarities ;
- (7) details of any concessions granted ;
- (8) design certificate for airscrew and
- (9) design certificates for other components.

CONSTRUCTION.

The principles governing "approved" and "unapproved" firms outlined for the *design* of the "Type" aircraft apply also to its *construction*. The inspection during construction should not be carried out by an organization which has had no previous

experience of such work. If such a course were adopted the Board would find it necessary to station its surveyors at the constructor's works to carry out a continuous check on organization, construction and inspection. An arrangement of this kind would be cumbersome and costly even if the Board could undertake the work, and whether the *designer* of the aircraft were approved or not, the Board would probably require that the inspection organization responsible for its construction be approved.

Accordingly, the constructor, if not already approved, would be well advised to obtain the services (part or full time) of an aircraft engineer suitably licensed in Category "B" (see A.R.B. Handbook No. 2) who would be able to put the organization on a basis suitable for the Board's approval in the appropriate category (see A.R.B. Handbook No. 3).

In the case of an approved firm, duplicate checks and inspections by the Board's surveyors are reduced to a minimum, which means in practice that only periodical checks by them of the organization and a final inspection of each main component are required.

In such an approved inspection organization, the Chief Inspector would be responsible for ensuring that :—

- (a) all materials used in the construction of the aircraft are in accordance with the specifications approved by the Board for the type design and by suitable examination, sampling and testing by approved methods, that every batch of such material complies with such specification ;
- (b) every detail and part of the aircraft has been examined by the constructor's inspection staff to the relevant approved detail drawings and that they conform to the approved type design ;
- (c) the constructor's inspection staff stamps, or otherwise provides means for the identification of each detail part approved by them in such a way that the individual responsible for such approval can subsequently be identified;
- (d) an efficient progress inspection during the work of assembly is maintained and records of the progress of such inspection for each component are made and that the inspection record is signed by the inspector responsible ;

A.N.D.
Section II
Para. 19

- (e) operations such as heat treatment of metals, seasoning and conversion of timber, glueing, doping, etc., are carried out by approved methods, and
- (f) all main components and assemblies of the aircraft are given a constructor's serial number and that this serial number is displayed in a prominent position on the completed component or assembly, and that detail parts of the structure are stamped to show the drawing or part number from which it has been made.

Note : With reference to (f) it is usual to use metal stamps for metallic parts and rubber stamps for non-metallic parts. In certain cases, such as control cables, it may be necessary to affix metal tabs and in the case of hardened steel parts which cannot be stamped, etching may be used.

Certain components such as airscrews, radiators and tanks, must show a drawing number and a serial number, and tanks must be marked to indicate their capacity and whether they are for petrol, oil or water.

Every component and detail part must carry a constructor's inspection stamp of a type that will ensure the identification of the person responsible for the inspection, the only exceptions being very fragile parts or minor parts such as split or taper pins. Metal inspection stamps for the stamping of metal parts must be provided with a border of circular or oval shape, triangular or square borders are not permitted as the corners may induce fatigue failure.

Evidence of heat treatment by normalising of a metal fitting is indicated by the letter "N" surrounded by a circular border.

The Chief Inspector must ensure that all components and parts obtained from sub-contractors have been inspected and approved in accordance with the above conditions. He must also be satisfied that the instruments and equipment fitted to the aircraft have been manufactured under approved conditions and that they comply with current "Civil Specifications" or have been approved by the Board.

The engine or engines installed must be of a type previously approved for use in civil aircraft.

During the construction of the aircraft the Board will from time to time indicate to the Chief Inspector when it considers it necessary for its surveyors to duplicate the firm's inspection of components and assemblies. Normally a surveyor will carry out a final inspection of each main component and affix his inspection stamp.

If necessary, the Chief Inspector may make application to the Board for a "Concession" to use a limited quantity of material or a limited quantity of details or parts which have

been incorrectly manufactured but are not unserviceable. Suitable record of such concessions must be kept by the Chief Inspector and be readily available to the Board's surveyor.

The Chief Inspector should keep in close touch with the representatives of the Board in connection with the inspection requirements that are particularly applicable to "Type" aircraft.

Before the official flight trials are carried out the aircraft must be weighed and the centre of gravity determined (for details see page 35 of this Handbook), and these operations will be carried out in the presence of the Board's surveyor.

On completion of all inspection operations, the aircraft will be submitted to the Board for final inspection and the firm's Chief Inspector will supply the Board with a summary of the inspection record of the aircraft. For this purpose A.R.B. Form 68 (copies of which can be obtained on application to the Board) is used. All the particulars required by the form must be given. Two profile photographs (size $4\frac{1}{4}$ in. x $3\frac{1}{4}$ in., i.e., quarter plate) of the aircraft, a weight schedule and a report of the determination of the centre of gravity must accompany this form.

When in the opinion of the Board the aircraft is safe for flight, the official flight trials may be commenced, and these trials will be carried out by the Board's test pilot or by a pilot approved by the Board.

Finally, the necessary recommendation is made to the Secretary of State that a Certificate of Airworthiness should be issued.

VIII

THE ISSUE OF A CERTIFICATE OF AIRWORTHINESS FOR A "SUBSEQUENT" AIRCRAFT

THE inspection during construction of a "Subsequent" aircraft is normally carried out by a firm holding Air Registration Board approval, and the inspection of such aircraft, including the items carried out by the Board in the case of the "Type" aircraft, is undertaken by the constructor's inspection staff.

A.N.D.
Section II
Paras. 6 & 20

The Board must be satisfied that the firm's inspection staff is competent to ensure that aircraft passed by it conform in all

essential respects to the "Type" aircraft. A periodical supervision of the constructor's inspection organization will be carried out by the Board's surveyors, and they may at their discretion inspect a "Subsequent" aircraft at any time during its construction.

On completion of the construction of a "Subsequent" aircraft, a final inspection is made and a certificate of fitness for flight is given by a representative or representatives of the constructor holding engineers' licences in Categories "A" and "C" covering the particular type of airframe and engine (see A.R.B. Handbook No. 2).

On completion of the whole of the inspection operations, the firm will supply the Board with the following documents :—

- (1) Civil Aircraft Inspection Record (A.R.B. Form 68);
- (2) Certificate of Particulars for the issue of a Certificate of Airworthiness (A.R.B. Form 52) in duplicate;
- (3) Weight Schedule, and
- (4) two profile photographs of the aircraft (size $4\frac{1}{4}$ in. x $3\frac{1}{4}$ in.—quarter plate).

All particulars, most of which are self-explanatory, required by Form 68 must be given. The application number on page I may be obtained from the Board. Details of the test flight carried out by the constructor's approved test pilot are entered on page X, and page XI is the certificate of fitness for flight completed by the licensed engineers as mentioned above.

Page XIII is a certification which is signed by the constructor's Chief Inspector or his deputy, that this "Subsequent" aircraft conforms in all essential respects to the "Type" aircraft. If the aircraft is different from the "Type" aircraft in that it embodies certain approved modifications, then the inspector is required to detail these modifications on page XII of the form.

The Certificate of Particulars (A.R.B. Form 52) provides the information required for the Certificate of Airworthiness which will eventually be issued and this form is compiled by the constructor in part from the Type Record or Technical Certificate of the "Type" aircraft. The form includes this certification :—

"I hereby certify that the aircraft described on page I hereof has been inspected during construction and tested in accordance with the requirements of the Air Navigation

Acts 1920-1936, and the Orders in Council in force thereunder."

This certification is normally signed by a surveyor to the Board.

The weight schedule must be in accordance with the requirements of the Directions (see page 35).

On receipt of the completed documents, the Board will recommend the Secretary of State to issue a Certificate of Airworthiness for the particular aircraft.

When desired by the constructor, and in the case of "Subsequent" aircraft only, a temporary "Short Term" Certificate of Airworthiness, valid for a period of fourteen days, will be issued when the Board makes its recommendation to the Secretary of State. This serves to cover the period before the issue of a certificate valid for twelve months.

A.N.D.
Section II
Paras. 32 & 33

IX

THE VALIDATION OF FOREIGN CERTIFICATES OF AIRWORTHINESS HELD BY BRITISH REGISTERED AIRCRAFT

His Majesty's Government and the governments of certain other countries have agreed to the reciprocal validation of Certificates of Airworthiness.

This means that an aircraft constructed in these countries which holds a Certificate of Airworthiness of the country of origin may have such certificate validated in this country providing that it complies with certain conditions.

Example:—
Treaty Series
No. 38 (1934)
Exchange of
Notes

The validation certificate is issued by the Secretary of State on the recommendation of the Board when it is satisfied as to the general condition of the aircraft. The grant of a validation certificate does not necessarily mean that the aircraft complies with the requirements for the issue of a British Certificate of Airworthiness. The validation certificate permits the aircraft to operate as if it held a British certificate, but may impose specified limitations and conditions.

S.R. & O.
Schedule II
Para. 12

The validation certificate is attached to the Certificate of Airworthiness of the country of origin and must be carried on

the aircraft for international navigation, public transport flying and aerial work. It is subject to the conditions of renewal of British Certificates of Airworthiness.

X

THE ISSUE OF A CERTIFICATE OF AIRWORTHINESS FOR AN EX-ROYAL AIR FORCE AIRCRAFT

IT may happen that a person becomes the owner of a second-hand "Service" aircraft and desires to obtain a Certificate of Airworthiness.

The owner must register the aircraft (see page 5 of this Handbook) and then make application to the Board for the issue of a Certificate of Airworthiness.

The particular type of aircraft may never have had a Certificate of Airworthiness, and the Board would be justified in requiring "Type" procedure to be followed as described on page 14 of this Handbook, but the normal procedure is that the Board accepts the "Type Record" submitted to the Air Ministry for "Service" aircraft.

The procedure adopted is generally that which is followed for the renewal of a Certificate of Airworthiness but, in addition, the Board must be satisfied that the aircraft conforms to civil requirements, that the instruments and equipment are as prescribed by the Air Navigation Directions.

XI

THE VALIDITY AND RENEWAL OF A CERTIFICATE OF AIRWORTHINESS

A CERTIFICATE of Airworthiness is usually valid for a period of twelve months and the period is inclusive of the issue and expiry dates.

The aircraft owner or his representative may at any time apply for the renewal of a Certificate of Airworthiness, but an aircraft may not be flown except for purposes of renewal, if the certificate has expired, unless written permission has been granted by the Secretary of State.

The Air Navigation Order authorizes the Secretary of State or his authorized representatives to limit or extend the period of validity of a Certificate of Airworthiness. He may at his discretion give instructions for the inspection, overhaul, and repair of any aircraft having a valid Certificate of Airworthiness, and he may cancel or suspend the Certificate of Airworthiness of any aircraft deemed to be unsafe after such inspection.

S.R. & O.
Schedule II
Para. 7

Notices to
A.O. & G.E.'s
No. 12 of 1939

RENEWAL OF CERTIFICATE OF AIRWORTHINESS.

Application for the renewal of a Certificate of Airworthiness should be made on C.A. Form 79 to the Board at least one month before the date from which renewal is required, in order that the necessary arrangements may be made for the inspection of the aircraft. The application should be accompanied by the appropriate fee in accordance with the scale which is given on page 43.

Upon receipt of the application, arrangements are made for a surveyor to the Board to inspect the aircraft.

The engineer responsible for the overhaul should submit the aircraft in a clean condition, suitably trestled and with all cowlings, inspection panels, etc., removed or opened, so that complete access to the interior and exterior of the aircraft and its controls is provided.

Any further dismantling at this stage is at the discretion of the Board's surveyor but in any case no major overhaul or repair should be embarked upon before a preliminary inspection by him has been made.

Airframe and engine log books must be produced for examination with entries complete and up to date. The Certificate of Airworthiness must be handed to the surveyor or forwarded to the Board with the application for renewal.

The Board's surveyor will decide the extent of overhaul and repair work to be carried out and a suitable inspection report in duplicate will be signed by him and the engineer in charge. The report will normally be made by the engineer and amended by the Board's surveyor as necessary. The inspection report

should be divided into component or assembly headings and under each sub-heading should be shown the component serial number and details of the overhaul work to be carried out on it. Unless otherwise agreed, components such as tanks, instruments, generators, etc., will automatically be reconditioned and tested.

Upon completion of the overhaul, the Surveyor in Charge of the local office of the Board should be advised that the aircraft is ready for final inspection.

The engineer must prepare a log book entry covering all the work carried out and must sign it as required by the Air Navigation Directions. In addition, the following certification should be made at the foot of the entry and signed by the engineer immediately responsible for the overhaul :—

“I hereby certify that all recommendations made by the Air Registration Board in respect of the overhaul of this aircraft for renewal of its Certificate of Airworthiness have been satisfactorily carried out.”

The engineer must supply the surveyor with reports of petrol flow checks, electrical tests and any other such reports as the Board may require. The surveyor will indicate whether or not he wishes to conduct these tests personally. The surveyor will also decide whether the aircraft is to be reweighed.

The surveyor will then carry out a final inspection of the aircraft and, if he is satisfied, the aircraft may be flight tested.

On completion of a satisfactory test flight and all the formalities described above, the surveyor hands to the owner or his representative a Short Term Certificate of Airworthiness which will normally be valid for a period of fourteen days. This certificate covers the interim period during which the original certificate is endorsed normally for a period of twelve months from the date of issue of the Short Term Certificate.

THE “CONTINUOUS OVERHAUL” FOR RENEWAL OF A CERTIFICATE OF AIRWORTHINESS.

During recent years it has been found undesirable to render large aircraft unserviceable for long periods for the purpose of carrying out overhauls for renewal of Certificate of Airworthiness, and in suitable cases where a number of aircraft of a particular type are operated a continuous overhaul system is permitted by the Board.

The system is not normally applicable to aircraft with a maximum permissible weight of less than twenty thousand pounds and in all cases the approval of the Board must be obtained before the system is adopted.

Past experience has shown that the continuous overhaul method is most satisfactory when an aircraft is available at its base for periods of several days in each month.

During these periods at the base, certain main components, assemblies or systems are selected for overhaul and an inspection is carried out by the Board's local surveyor. Carefully compiled records of these overhauls are maintained and if, at the end of twelve months, these show that every part of the aircraft has been overhauled to the requirements of the Board, then, after certain determinations have been made which will include reweighing, petrol flow tests and flight trials, the Board will recommend the renewal of the Certificate of Airworthiness.

EXTENSION OF THE VALIDITY OF A CERTIFICATE OF AIRWORTHINESS.

In special circumstances such as the case of aircraft operating over long distance air routes, the Secretary of State may grant a short extension to the period of currency of a Certificate of Airworthiness. The granting of such extensions are exceptional, and when granted, they are normally limited to a period not exceeding one month.

Application should be made by letter to the Air Ministry and applicants should give reasons for the application and state when and where the aircraft may be inspected.

The inspection may be carried out by a surveyor to the Board and any rectification required must be made and certified before the Board can recommend the extension.

XII

MODIFICATIONS TO AIRCRAFT

"MAJOR" MODIFICATIONS.

MODIFICATIONS which, in the opinion of the Board, may affect the safety of an aircraft are termed "Major" modifications. When such modifications are embodied, the particular aircraft

A.N.D.
Section II
Paras. 34, 35, 36

may not fly, except for test purposes, until the modifications are approved by the Board.

An aircraft to which a Certificate of Airworthiness has been issued but in which major modifications are incorporated is termed a "Type (Modified)" aircraft.*

Application must be made to the Board for the approval of such modifications, and the procedure followed is similar to that for the approval of design and inspection for "Type" aircraft. The Board may, however, dispense with official flight trials or other part of the normal procedure considered unnecessary or inapplicable in a particular case.

The fee for approval of a "major" modification is assessed by the Board and is dependent on the design investigation and the inspection that the particular modification demands.

Following approval, the modification may be recorded as an addendum to the Type Record and thereafter such modification may be embodied in any "Subsequent" aircraft.

If the Board considers that a modification to a particular type of aircraft is necessary for safety, it may require such modification to be carried out as a condition of the validity of the Certificate of Airworthiness.

"MINOR" MODIFICATIONS.

A modification which, in the opinion of the Board, does not affect the safety of an aircraft is termed a "minor" modification but, although "minor", it requires formal approval.

The procedure involves decision by the Board on whether a modification is properly to be regarded as "major" or "minor." This decision is based on the following considerations.

A "minor" modification is one which a surveyor to the Board decides, on the basis of his knowledge and experience and without recourse to calculations, test or other design investigation, does not reduce safety.

"Minor" modifications are, broadly speaking, of three types. The first is the obviously trivial modification which may be approved by a licensed engineer. (This is recorded by him in the appropriate log book.) The second is the rather more important modification which the licensed engineer thinks might

*An aircraft to which a Certificate of Airworthiness has *not* been issued and which has had "major" modifications incorporated, is termed a "Type (Reduced Fee)" aircraft. (See page 14.)

conceivably affect safety. He refers the matter to the nearest Board's surveyor who may decide that it is to be treated as a "minor" modification. In this event, the surveyor will issue to the applicant for the approval of the modification a statement (A.R.B. Form 61) defining the modification, giving the registration marks and type of the aircraft to which it applies, referring to any relevant drawings and stating that the modification is deemed to be a "minor" modification. The licensed engineer concerned will, on the basis of this statement, make a suitable entry in the appropriate log book and sign it.

The third is one in which the surveyor is doubtful whether the modification can be cleared as a "minor" modification and he will refer the matter to the Board's Chief Technical Officer. Should the latter deem the modification to be a "major" one, he will instruct the surveyor to inform the applicant that he must make formal application for approval under "major" modification procedure. If, on the other hand, the Chief Technical Officer decides that it can be treated as a "minor" modification, he will issue a statement, of the kind described above, to the applicant through the surveyor concerned. The surveyor will hand a copy to the licensed engineer who will, on the basis of this statement, make a suitable entry in the appropriate log book and sign it.

In the case of any modification which has been defined as a "minor" modification by the surveyor or the Chief Technical Officer, the surveyor concerned will use his discretion whether to inspect the modification himself or to leave this to the licensed engineer.

"Minor" modification action may sometimes start in a different way. The owner or constructor may make application to the Board for approval of a "major" modification in accordance with the requirements of the Air Navigation Directions. The Board may decide, after investigation, that the modification may be treated under "minor" modification procedure. In this case, the Board will issue a "minor" modification report (A.R.B. Form 61) and will send a copy of this to the applicant. Any fees paid will be returned to the applicant.

It is not always essential that the "minor" modification should be inspected by the Board, but it is necessary for a suitably licensed engineer to check that the modification made to the

aircraft is, in fact, the modification which has been certified in the "minor" modification report.

Notes : The foregoing should not be confused with the requirements of Notice to Aircraft Owners and Ground Engineers No. 33 of 1937, which only deals with modifications which affect the safety of the aircraft. "Minor" modification procedure deals only with modifications which are certified as *not* affecting safety. This "minor" modification procedure has been introduced by the Board to put this certification on a proper basis without charge to the applicant.

The functions of licensed engineers in connection with "minor" modification procedure may also be performed by the authorized representative of a firm or company approved by the Board. (See A.R.B. Handbook No. 3.)

Certification in the appropriate log book is subject to the provisos of A.N.D. 13, para. 59.

XIII

THE FITTING OF COMPONENTS AND SPARE PARTS EX-ROYAL AIR FORCE

AN owner or operator of civil aircraft may desire to use new or second-hand components or spare parts which have been purchased from the Royal Air Force. In this event, the Board requires the following procedure to be adopted :—

- (a) the Board must be satisfied that the component has been manufactured by the aircraft constructor or his authorized sub-constructor ;
- (b) the component or spare part must be identified by the constructor's serial number and/or drawing number ;
- (c) the component or spare part must be inspected and certified by a suitably licensed engineer or approved firm, and
- (d) full details of the origin and fitting to the aircraft must be entered in the relevant log book and certified by a licensed engineer or an approved firm.

XIV

INSTRUMENTS AND EQUIPMENT TO BE CARRIED BY BRITISH AIRCRAFT

THE instruments and equipment that must be carried and maintained in working order by every British aircraft registered in Great Britain and Northern Ireland when flying, vary with the particular flight to be undertaken and whether it is undertaken in a private capacity or for public transport.

S.R. & O.
Article 14

A.N.D.
Section II
Para. 23

A.N.D.
Section VIII
Para. 64

A Certificate of Airworthiness will not be issued or renewed and licensed engineers must not sign Daily Certificates of Safety for Flight unless certain prescribed instruments and equipment are fitted to the aircraft.

The licensed engineer is responsible for seeing that the essential instruments and equipment are in serviceable condition and installed to approved requirements. Certain aircraft may contain instruments and equipment such as cylinder head temperature gauges, rate of climb indicators, automatic pilots and cabin heating systems, which are not required by the regulations, and the unserviceability of these non-essential instruments and equipment does not prevent the issue or renewal of a Certificate of Airworthiness or preclude a licensed engineer from signing a Daily Certificate of Safety for Flight provided that the unserviceability of such instruments and equipment does not affect the safety of the aircraft.*

The details of essential instruments and equipment are laid down in the Air Navigation Directions as amended by the Air Navigation Regulations, but for easy reference a summary of the requirements is given :—

Aircraft Classification.
(See page 7)

Requirements.

NAVIGATIONAL INSTRUMENTS

Aircraft in Normal Category.

Subdivisions (a) (b) (c) & (e).

Airspeed Indicator.
Altimeter.

*It is strongly recommended that, when an instrument or item of equipment is unserviceable this should be clearly indicated.

Aircraft Classification.
(See page 7)

Requirements.

NAVIGATIONAL INSTRUMENTS—*continued*

Aircraft in Normal Category.

A.N.D.
Section VIII
Para. 64

Subdivisions (a) (b) (c) & (e). For flights which extend beyond 20 miles from point of departure.	Compass. Watch. *Artificial Horizon or Longitudinal Incline Indicator. *Directional Gyro or Turn Indicator. Map or maps to cover route of proposed flight.
Subdivision (d).	Airspeed Indicator. Altimeter.
<i>Special Category.</i> Subdivisions (f) & (g).	Airspeed Indicator. Altimeter.

Acrobatic Category.

As for Normal Category.

ENGINE INSTRUMENTS

Aircraft in all categories must be fitted with :—

Revolution Indicator and such gauges as are considered necessary by the Secretary of State for the particular installation.
(e.g., an oil pressure gauge would normally be required, a boost gauge in the case of a supercharged engine and a coolant temperature gauge in the case of a liquid cooled engine.)

*When an aircraft is capable of carrying 10 or more persons including crew, an Artificial Horizon and Directional Gyro are compulsory.

Aircraft Classification.
(See page 7)

Requirements.

SAFETY HARNESS, BELTS AND LAP STRAPS

Normal and Special Categories.

All subdivisions.

Safety belts for pilot or pilots.

Lap strap for every other seat provided in the aircraft.

Note : This requirement applies to passengers and crew.

Acrobatic Category.

All subdivisions.

All seats in aircraft operated in this category must be fitted with safety harness.

LIFEBELTS

Normal and Acrobatic Categories.

Subdivisions (a) (b) & (c).

Lifebelts for each person on board (place of stowage to be marked and notice to be displayed showing location and method of use).

For flights of 10 miles from nearest land.

AXE

Normal and Acrobatic Categories.

Subdivisions (a) (b) & (c). When carrying 10 or more persons including crew.

An axe to be carried suitably stowed as to be readily accessible to the crew.

Aircraft Classification.
(See page 7)

Requirements.

FIRE EXTINGUISHERS*

Normal Category.

Subdivisions (a) (b) & (c).

Hand fire extinguisher.

All aircraft for all flights.
When carrying 10 or more persons including crew.

Hand fire extinguisher in each main passenger compartment, with a minimum of two extinguishers.

Subdivision (e).

Hand fire extinguisher to be fitted in each compartment.**

Acrobatic Category.

As for Normal Category.

OXYGEN

All aircraft carrying passengers or goods for hire or reward for flights above 15,000 feet.

A supply of oxygen and suitable apparatus for use by passengers and crew.

EMERGENCY EXITS

Normal and Acrobatic Categories.

Subdivisions (a) (b) & (c).

Every passenger compartment to have an emergency exit either in the compartment or easily accessible. In the latter case the ordinary exit must not be capable of locking or must be easily breakable.

*All new type aircraft in subdivisions (a) (b) or (c), the applications for a Certificate of Airworthiness for which were received by the Air Ministry on or after 1-8-39, must be equipped with fire extinguishers of approved types installed in such a manner that they can be operated from the cockpit to extinguish fires in engine nacelle or nacelles.

**A hand fire extinguisher must be carried in each smoking compartment of any aircraft in which smoking is permitted.

In every aircraft carrying fire extinguishers, one must be readily available for use by the pilot.

Aircraft Classification.
(See page 7)

Requirements.

EMERGENCY EXITS—*continued*

Normal and Acrobatic Categories.

Subdivisions (a) (b) & (c).

Suitable emergency exits must be provided for members of the crew. S.R. & O. Article 9 Para. 8

The total number of exits to be at least one exit for every three seats.

NIGHT FLYING*

All aircraft when used for flights by night.

Navigation lights and the lighting of instruments and any equipment and maps which are required.

DE-ICING

Normal Category.

Subdivisions (a) (b) & (c).

Aircraft carrying 10 or more passengers.

When icing conditions are likely to be encountered.

De-icing equipment for :—
A.S.I. system.
Blind Flying installation.
Pilot's windows.
Wireless fixed aerial.
Direction finding loops.
V.P. Airscrews.
Carburetters.
Fuel and Oil Tank Vents.

For flights on a regular line by a public transport service. When icing conditions are likely to be encountered.

De-icing equipment to be fitted to : Leading edges of wings, tail and control surfaces.

*All hire or reward aircraft require landing lights (lamps or wing tip flares) of an approved type for night flying.

*Aircraft Classification.
(See page 7)*

Requirements.

MARINE EQUIPMENT

A.N.D.
Section VIII
Para. 64

Marine aircraft above 5,000 lb.
max. total weight.

Such fittings and accessories as
are necessary for manoeuvring
in harbour, including two
drogues capable of being paid
out astern when the aircraft is
being towed.

LANDING GEAR INDICATORS

A.P. 1208 Vol. I
Leaflet B.10

Amphibian aircraft and land-
planes with retractable under-
carriages.

An indicator to show the posi-
tion of landing wheels.

NAVIGATIONAL EQUIPMENT.

A.N.D.
Section XI

All aircraft used for the international carriage of passengers or goods for hire or reward which fly without landing more than 100 miles by day or 16 miles by night must have a licensed navigator on board.

When the seating capacity, including crew, of the aircraft is more than five, a drift indicator must be provided.

A chart table and navigational instruments must be provided when a navigator other than the pilot is on board and, if the pilot's instruments are not readily visible to the navigator, then an additional airspeed indicator, altimeter and compass must be fitted.

WIRELESS APPARATUS AND OPERATORS.

A.N.D.
Section IX

Aircraft capable of carrying ten or more persons including the crew, when carrying passengers or goods for hire or reward, must have wireless apparatus for sending and receiving Morse or spoken messages.

When the regulations require that an aircraft shall carry wireless apparatus then a wireless operator, licensed by the Postmaster-General, must be carried.

S.R. & O.
Article 14A

SIGNALLING EQUIPMENT.

All aircraft must carry sufficient equipment for making distress, urgency, and safety signals when performing flights beyond a radius of three miles from point of departure.

S.R. & O.
Schedule IV
Section I

These signals may be made with any or all of the following :—

Radio telegraphy.	Pyrotechnical cartridges.
Radio telephony.	Flags.
Lights.	Sound Apparatus.

XV

THE WEIGHING AND DETERMINATION OF THE CENTRE OF GRAVITY OF AIRCRAFT

It has already been stated in this handbook that every aircraft must be weighed before a Certificate of Airworthiness is issued and that an approved form of weight schedule must be compiled. The aircraft must also be reweighed and the schedule amended when required by the Board.

A.N.D.
Section II
Paras. 32-33

In general practice, unless major modifications or repairs have been carried out, reweighing takes place at the annual Certificate of Airworthiness renewal overhaul of all aircraft operated in the hire or reward categories. In special cases, this may be waived if weighing facilities are not available and careful records have been kept of weight removed or added.

It is usually unnecessary for private aircraft to be reweighed annually, but the Board's surveyor will normally make a careful check of the aircraft and its equipment against the existing weight schedule before renewing the Certificate of Airworthiness.

Two copies of the weight schedule are required, one of which is handed to the Board's surveyor and the other placed in a prominent position in the aircraft where it may readily be seen.

A sample weight schedule which has been compiled to the requirements of the Air Navigation Directions is as follows :—

Aircraft Type : *Registration :*
Part A. The undermentioned items of equipment are included in the "Weight Empty" figure painted on the fuselage and recorded at item 25 on the relative Certificate of Airworthiness (C.A. Form 59).

1. One Airspeed Indicator	15. Demec Navigation Lights
2. One Altimeter	16. Cabin and Cockpit Lights
3. One Compass	17. One Landing Lamp
4. One Turn Indicator	18. One Safety Belt
5. One Altimeter (sensitive)	19. Two Electric Engine Starters
6. One Artificial Horizon	20. One Fire Extinguisher
7. One Directional Gyro	21. One First Aid Kit
8. One Fore and Aft Level	22. One Trailing Aerial
9. One Watch	23. One Fixed Aerial
10. One Air Thermometer	24. One Dual Generator
11. Two R.P.M. Indicators	25. One Windscreen Wiper
12. Two Oil Pressure Gauges	26. Pilot's Seat and Cushions
13. One Electric Fuel Gauge	
14. One 25 Amp-hr. Battery	

Part B. Weight particulars recorded at Items 25-32 inclusive of the C.A. Form 59 showing total quantity of fuel and oil which the tanks will hold, also details of equipment and apparatus which make up the weight recorded opposite Item 29 of C.A. Form 59.

<i>Item Nos. (Certificate of Airworthiness, C.A. Form 59)</i>	<i>Weight</i>
25. Weight Empty	3,395 lb.
26. Fuel :—76 galls. at 7.7 lb. per gal.	585 „
27. Oil :—7 galls. at 9 lb. per gal.	63 „
28. Weight allowed for crew (one)	170 „
29. Movable equipment comprising :—	
(1) Eight Cabin Chairs c/w Lap Straps	80 lb.
(2) Nine Life Belts	22 „
(3) One Set Carpets	16 „
	— Total 118 „
30. Wt. of Wireless apparatus	40 „
31. Max. commercial load authorized (with fuel and oil tanks full)	1,179 „
32. Max. total weight authorized	5,550 „
<i>Note : This Weight Schedule cancels all previous weight records for this aircraft.</i>	
Aircraft weighed at	Date
Signed	Chief Engineer
Signed	A.R.B. Surveyor

Part "A" of the schedule lists in detail the instruments and equipment which are included in the Empty Weight shown at Item 25 in Part "B."

The weights itemised in Part "B" are numbered 25 to 32 to conform to the item numbers in the Certificate of Airworthiness.

The weight empty is the weight of the completed aircraft ready to fly with all fixed equipment, including water or coolant in radiators if applicable, but excluding the weight of crew, fuel and oil and any removable equipment.

The weight of fuel must be calculated from the specific gravity of the particular fuel to be used (usually stated in the Certificate of Airworthiness Compulsory Conditions), and this may vary between 7.1 and 7.7 lb. per gallon. The weight of oil is calculated at 9 lb. per gallon and the crew may be considered as weighing 170 lb. each.

Items 29 and 30 detail the movable equipment and any movable wireless apparatus. Item 31 specifies the maximum commercial load and is calculated by adding Items 25 to 30 and deducting the result from the maximum total weight authorized at Item 32.

The weight empty and the maximum total weight authorized must be painted on the rear fuselage or hull in a prominent position near the tail plane.

Aircraft with long range tankage may have no commercial load when the tanks are full, or they may have a total weight authorized for the take-off in excess of the total weight authorized for landing, but these are special cases necessitating the use of fuel dumping systems or restrictions, details of which will always be given in the Certificate of Airworthiness in the form of Compulsory Conditions.

DETERMINATION OF THE CENTRE OF GRAVITY OF AN AIRCRAFT.

The longitudinal position of the Centre of Gravity of all "Type" aircraft must be determined before the issue of a Certificate of Airworthiness. Calculation of the vertical centre of gravity is not normally required for civil aircraft.

A centre of gravity check may be requested by the Board before the issue of a Certificate of Airworthiness to a "Type (Reduced Fee)," "Subsequent" or "Type (Modified)" aircraft

or before renewal of a certificate, when it is suspected that structural alterations or changes in equipment have affected the centre of gravity position.

The check is usually made with the chord line horizontal and the aircraft in the "empty" condition. A record of the calculation must be made and A.R.B. Form 62, which is self-explanatory, may be used for this purpose.

The centre of gravity position is defined as a certain distance from the leading edge of the mainplane or leading edge datum or in other cases from a specified position.

The determination of the centre of gravity at the maximum permissible all-up weight of the aircraft may be calculated by the addition or subtraction of moments about the specified position.

XVI

THE CERTIFICATION OF AIRCRAFT BY LICENSED ENGINEERS

DAILY CERTIFICATE OF SAFETY FOR FLIGHT.

S.R. & O.
Schedule II
Para. 8
A.N.D.
Section IV
Paras. 55-56A

THIS certification is made by a licensed engineer who is a competent person licensed by the Secretary of State. Engineers signing Daily Certificates of Safety for Flight in respect of airframes and engines are licensed in categories "A" and "C" respectively (see A.R.B. Handbook No. 2).

This certification must be made at least once in twenty-four hours and the only exception to this requirement is that, if an aircraft lands due to an accident, stress of weather or other unavoidable cause, it may, with certain provisos, complete its journey if the pilot is satisfied that it is safe for the proposed flight.

CERTIFICATE OF FITNESS FOR FLIGHT (SUBSEQUENT AIRCRAFT)

A.N.D.
Section II
Para. 20(d)

It has already been stated on page 20 that in the case of "subsequent" aircraft produced by an aircraft constructor, it is required that, before flight, a licensed engineer should inspect each aircraft and sign a Certificate of Fitness for Flight.

The certificate referred to is contained in the Civil Aircraft Inspection Record of the aircraft (A.R.B. Form 68) and must be signed by engineers licensed in Categories "A" and "C."

THE CERTIFICATION OF OVERHAULS, REPAIRS, MODIFICATIONS AND REPLACEMENTS.

The regulations require that if the validity of the Certificate of Airworthiness is to be maintained, any overhaul, repair, modification or replacement made to an aircraft to which a Certificate of Airworthiness has been granted, must be certified by an engineer licensed in the appropriate categories by the Secretary of State or by a firm approved for the purpose by the Board.

The certification is made in the relevant log book. When relating to the airframe or instruments or equipment, it will be inserted in the aircraft log book, and when relating to the engine it will be inserted in the engine log book. It will be signed by a qualified licensed engineer.

XVII

THE ESSENTIAL DOCUMENTS RELATING TO A BRITISH REGISTERED AIRCRAFT

THE regulations require that the following documents must be carried by all British registered aircraft :—

S.R. & O.
Article 15

When engaged in international navigation :—

- (a) Certificate of Registration ;
- (b) Certificate of Airworthiness and any other certificate relating to the aircraft which may be required to be carried by the regulations ;
- (c) Certificate of competency and licences of the aircraft personnel ;
- (d) Journey Log Book ;
- (e) Licence for wireless apparatus ;
- (f) List of passengers and
- (g) Bills of Lading in respect of freight, etc.

Note : When not engaged in international navigation but when flying as a public transport aircraft or an aerial work aircraft (b) and (c) only are compulsory.

From this it will be seen that a privately owned aircraft need not carry any documents unless engaged on international navigation. The private owner must, however, when requested to do so authoritatively, produce the necessary documents within a reasonable time.

The words "any other certificate" mentioned at (b) would, in the case of hire or reward aircraft, include a Daily Certificate of Safety for Flight signed by a licensed engineer in respect of the airframe and engines (see A.R.B. Handbook No. 2).

Licences and certificates of competency mentioned at (c) include pilots', navigators' and radio operators' certificates.

LOG BOOKS.

S.R. & O.
Schedule III

A journey log book must be kept and carried by all aircraft engaged in international flying and must be kept and carried by aircraft in the hire or reward categories whether engaged in international flying or not.

The original journey log book is issued by the Air Ministry on request at the time of issue of the first Certificate of Airworthiness and log book refills may be obtained as required from the Air Ministry. (Log books 3s. 6d., refills 2s.) The journey log book is usually maintained by the pilot of the aircraft and the entries refer to flying times and journeys made. A pocket at the back of the book provides stowage for the Certificate of Airworthiness and Certificate of Registration and other necessary documents.

S.R. & O.
Article 16

A.N.D.
Section X
Paras. 72-78

Airframe and engine log books are compulsory for public transport or hire or reward aircraft, and are usually provided in the first place by the constructor of the aircraft or engine concerned. These log books may also be purchased direct from His Majesty's Stationery Office or through a bookseller, price 2s. 6d. each.

The constructor's Chief Inspector is responsible for completing the initial entries in these log books and there are pages for rigging details and other informative data in the front of the books.

The books are intended to be a complete history of the airframe or engine and the entries should be suitably certified. The hours flown by the aircraft and the running time (including

ground running) of the engine must be recorded so that the times since manufacture and since overhaul can be readily seen.

Details of all overhauls, repairs, modifications and replacements made to the aircraft or its engine must be entered in the relevant log book and, in the case of replacements, the approval reference and serial numbers must be quoted.

Each entry must be signed and dated and, when signed by a licensed engineer, his licence number and the categories in which he is licensed must be added.

The airframe and engine log books must never be carried by the aircraft in flight. Operators must retain old log books for a period of at least two years.

Since the introduction of variable pitch airscrews which are subject to overhaul and adjustment independently of the engine to which they may be fitted, airscrew log books are now in general use, although they are not required by the regulations. They are maintained in much the same manner as the engine log book.

Although it is not compulsory for private owners of aircraft to maintain airframe and engine log books, they are advised to do so, or to maintain some form of record. In any case, a record of any modification or replacement made to the aircraft must be available to the Board's surveyor at the time of renewal of the Certificate of Airworthiness.

XVIII

APPROVAL OF AIRSCREWS

WHEN an airscrew is fitted to an engine it must be approved by the Board as being suitable for that type of engine when installed in a particular type of aircraft.

For example, an airscrew fitted to a single-engined aircraft may not be suitable for a multi-engined aircraft, although the engines may be of the same type.

A list of approved airscrews is published periodically in Notices to Aircraft Owners and Ground Engineers.

The fitting of an airscrew, to an aircraft having a Certificate of Airworthiness, which has not hitherto been approved, constitutes a "Major" modification and design approval must be obtained in the normal way (see page 25). It is permissible and sometimes convenient to deal with the design approval of an airscrew without requiring the applicant to relate his application to a particular aircraft. He may relate it instead to all aircraft of a given type.

If an airscrew type has already been approved for use on a particular airframe-engine combination, and an application is made for approval of the same type of airscrew on a different airframe-engine combination, then, if the design investigation involved is negligible, this can be dealt with under minor modification procedure.

XIX

THE APPROVAL OF WIRELESS APPARATUS INSTALLED IN AIRCRAFT

A.N.D. Section IX

EVERY British registered aircraft capable of carrying ten or more persons including crew, must, when carrying passengers or goods for hire or reward, carry wireless apparatus capable of sending and receiving Morse or spoken messages by wireless telegraphy.

The apparatus must be of an approved type and the installation must be in accordance with requirements of the Air Ministry and the Board.

Initial installation of radio apparatus in an aircraft creates a new "aircraft radio station" and the aircraft owner or operator must :—

- (a) make application to the Air Registration Board for approval of the modification to the aircraft arising from the installation of the apparatus.
- (b) apply to the Air Ministry for approval of the aircraft radio station (i.e., the apparatus), and

(c) apply to the General Post Office for a licence to establish the aircraft radio station.

If the changes in the aircraft structure weight, centre of gravity position or flying characteristics resulting from the installation of radio apparatus do not appear to affect the safety of the aircraft, the Board may decide that the installation can be treated as a "Minor" modification.

Application for radio approval is made on C.A. Form 120 to the Signals Department of the Air Ministry, and the approval involves a survey of the complete station by an Air Ministry Radio Surveyor.

A copy of C.A. Form 120 should be forwarded to the G.P.O. Telecommunications Department, together with a fee of five shillings for the issue of a radio licence.

XX

FEES

		£ s. d.
Registration of aircraft	I I O
*Re-registration of aircraft	I I O
Issue of Certificate of Airworthiness for "Type" aircraft :—		S.R. & O. Schedule VI
When the tare weight does not exceed	500 lb. ..	25 0 0
	750 lb. ..	50 0 0
	1,000 lb. ..	60 0 0
	1,500 lb. ..	70 0 0
	2,000 lb. ..	80 0 0
	3,000 lb. ..	88 0 0
	4,500 lb. ..	100 0 0
	6,000 lb. ..	112 0 0
	8,000 lb. ..	128 0 0
	10,000 lb. ..	144 0 0
	12,500 lb. ..	160 0 0
for each additional	2,500 lb. ..	15 0 0
Issue of Certificates of Airworthiness for "Subsequent" aircraft	5 5 0

*In certain circumstances this may be reduced to five shillings.

£ s. d.

Renewal of Certificates of Airworthiness

(a) When the maximum total weight authorized as shown in its Certificate of Airworthiness does not exceed 2,000 lb. 5 0 0

(b) When the maximum total weight authorized as shown in its Certificate of Airworthiness exceeds 2,000 lb. :—

(i) in respect of the first 2,000 lb. 5 0 0

(ii) in respect of each additional 300 lb. or part thereof.. 1 0 0

Issue of a Certificate of Airworthiness to "Type (Reduced Fee)" aircraft A proportion of the Type fee dependent on investigation and inspection necessary.

Extension of validity of Certificate of Airworthiness A proportion of C. of A. renewal fee, viz., one month's extension— $1/12$ of annual renewal fee (Min. £1 10).

Issue of Duplicate Certificate of Registration 5 0
Issue of Duplicate Certificate of Airworthiness 5 0

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